extent of activity, whether of a single organ or of the whole individual, the case is even more puzzling. The activity of the circulatory system, which extends throughout the entire body, is excluded, whereas the isolated pupillary reflex is included. It is also not easy to see why Woodworth includes emotion and attention among native traits. Emotion, he says, "consists wholly of the sensations of bodily changes." Why, then, is it listed as a separate trait? Why is it not included in the chapter on sensation and discussed as a blend? Elsewhere, we read that "all the emotions belong under the general heading of the feelings." Attention from the objective point of view gives us nothing new; it practically amounts to emotion, instinct and impulse. From the subjective point of view, however, we find that "we are more conscious of that to which we are attending than of anything else;" attention is a high degree of consciousness. Since degree of consciousness tallies, not with intensity of sensation or energy of muscular action, but with degree of mental activity (p. 266); and since mental activity is defined as conscious or near-conscious activity; it follows that attention is a high degree of consciousness which goes with a high degree of conscious or near-conscious activity.

The discussion of attention brings up the question of degree of consciousness. What does this expression mean? How can there be, for instance, degrees of consciousness in the field of sensation? This trait, be it remembered, is not cognitive. When we pass to the more complex levels, awareness and cognition appear, and degrees of consciousness find ready application. Still, even at the cognitive level, the concept is not without its pitfalls; it implies a permanent mind, a knower, and carries us back to the old 'self-activity' psychology. This implication is also present in Woodworth's concept of tendency. His exposition is straightforward and clear in the explanation of tendencies and the treatment of native traits; but in his discussion of the acquired traits and of the modifications which follow the laws of exercise and combination the implication of a permanent mind is very apparent. For example: how can use or exercise modify a native trait? Modification is explainable only by the tacit assumption of the middle term, the tendency, which is effective in both directions: toward the stimulus, in the substitution and detachment of the original stimulus; toward the response, in the substitution and combination of responses.

The style of the book is colloquial, facetious, and even slangy, as some of the excerpts already quoted show, and as the following remarks will further illustrate: "The dog passed another on the way without so much as saying 'How d'ye do?'"; "We had better fetch that law out again and put it in good repair and see whether it is adequate for the job that we now have on hand;" "Now bring in our trusty law of exercise;" "The law of combination seems to fill the bill very well;" "Errors of any kind are meat to the psychologists;" "Not that Freud would get our OK." It is at least doubtful whether this innovation is of advantage to a scientific text-book.

K. M. D.

Die Grundlagen der psychischen Entwicklung. Eine Einführung in die Kinderpsychologie. By K. KOFFKA. Osterwieck am Harz. 1921. Pp. viii+278.

This book is more than a restatement of facts and inferences regarding mental development and the psychology of childhood; it is a reinterpretation of the genesis of mind according to certain principles of mental structure which have grown out of the recent experimental work on *perception* undertaken by Köhler, Wertheimer, Koffka, and their collaborators. The new point of view is radical in its abandonment of the conscious element as a unit of structure, for with this go also the law of association,

as commonly understood, and likewise the well-worn mechanistic conception of interconnecting neural pathways. In place of the older theory of mind as originally a chaos of discrete elements which must be associated together by frequent repetition in order that certain 'bonds' of connection may be established as habits, the new structural psychology finds a 'closed system' already formulated as an original phenomenal datum. Corresponding to this is a 'closed system' on the physical side which replaces the discrete stimulus; while mediating between the two are the functional uniformities of the organism in its biologically adaptive processes.

From this point of view the mechanistic interpretations of behavior advanced by Thorndike and Watson come in for detailed criticism. Over against the experiments of the American students of animal behavior are placed those recently carried out by Wolfgang Köhler at the experimental station established by the Prussian Academy of Science at Teneriffe. As an indication of the difference, both in method and results, which arises from so radical a difference in the point of view from which the problem of behavior is attacked, we may state the case briefly as Koffka presents it.

Thorndike, in his famous puzzle-box experiments, confronts the animal with a task which can be solved only by chance. The appropriate response by which release from the box is obtained is not one which the animal could readily understand, even if it had the capacity of understanding. Hence the trial-and-error method employed is both tedious and wasteful. That the animal does, nevertheless, succeed eventually in mastering the situation is not explained by repetition alone, as Thorndike admits; nor is it explained by the satisfaction that attends an effective performance, since neither a preformed neural readiness to do the act in question nor a pleasurable nuance attaching to this fortuitous activity can be assumed. The animal learns here, as elsewhere, according to Koffka, by the formation of a functional structure which includes in its continuous course the 'situation' of hunger and irritability upon confinement, the selective manipulatory act of release, and the subsequent enjoyment of freedom and food. But the conditions under which this complex series of states and events is formed are the worst possible in which to reveal inventiveness or intelligence. Hence the act is but slowly acquired, and readily forgotten, because the important factors in the total structure are motor rhythms which do not naturally find a place in the original impulsive situation. Yet even here the type of activity involved in the release has an important bearing upon the efficiency of the animal's learning. When Thorndike taught his cat to lick itself before he would open the cage and release it, he found that the act in question rapidly degenerated into the merest rudimentary gesture; and if not then given its freedom the cat failed to repeat the performance immediately as it would always do when its act had a direct bearing upon the mode of release. Thorndike was unable to explain this fact, but Köhler's observations lead him to conclude that the behavior of the animal is always typically different when the act it is called upon to perform is, from its point of view, senseless. An efficient performance in solving a problem always involves some 'insight' on the part of the animal, that is, the means taken to achieve the end always indicate an inner structural connection.

Thus Köhler in his experiments with chimpanzees and hens always planned a situation where insight was possible, leaving the results to determine whether it was present or not. In general the arrangements in Köhler's tests were such that, in order to secure a reward, the animal must discover an indirect means by the use of a tool or by overcoming some hindrance in its way. Thus a basket of fruit placed outside of the ape's reach could be secured by pulling on a string attached to the basket, by poking it forward with a stick, or by mounting upon a box which the ape must first place under it. These tasks were not always easy to perform, but

the achievement, after many vain attempts interspersed with periods of rest, was always a sudden and immediate reaction in which the means employed in attaining the end had all the characteristics of an intelligent discovery. One of the most interesting of these discoveries was the use made of two pieces of bamboo by putting the smaller into the end of the larger to give a needed extension. The ape had previously poked out one stick by means of the other until it touched the basket, but it was only in what appeared to be an idle moment of play that the discovery of fitting the smaller into the larger stick was made. At once the animal went for the basket with the now lengthened stick, and though the sticks fell apart because they had not been well put together, the ape was not deterred in its purpose, but refitted them again, and fetched in the fruit.

That structural formulations are original phenomena of the mind, and not a product of previous learning, is indicated by the experiments with hens, a species not precisely noted for intelligence. Having found that hens can discriminate light and dark papers, these were placed on food boxes and the hen trained to select the box with the darker label. In the course of the experiment care was taken to alter the position and also the papers, so that the cue should be given by the specific brightness and not by any other factors. After training, 'critical' tests were made in which a lighter or a darker color than either of those in the training series was exposed along with the 'positive' color which the hen had been taught to select, or the 'negative' color which it had been taught to reject. If behavior is originally determined by a discrete stimulus we should expect the hen always to select the positive color, whenever present, and likewise always to reject the negative color. But this was not the case; if the hen had been taught to select the darker of two colors, it continued to select the darker, even when the box in question had been the 'negative' box in the training series. Likewise it rejected what had been the 'positive' box in favor of one whose color label was still darker.

From such results as these Koffka elaborates a theory of structural phenomena upon the basis of which he proceeds to give a reinterpretation of mental and bodily development, the nature of reflexive and instinctive activity, and the mode of learning. The genesis of a phenomenal structure is the appearance of a *quality* limited and somewhat definite on a background which is both vague and indefinite. These are the most primitive phenomena of perception in which every member of the structure carries all the other members along with it. Thus, the discovery of any particular member, as such, is the creation of a new structure, which has not previously existed. Whatever arises in consciousness as a structure is something to which the organism reacts, being conditioned not only by the corresponding structures involved in the physical impression, but likewise by biological needs and impulses of behavior. Thus 'friendliness' and 'unfriendliness' are more primitive structures than a *blue spot*, and in the original structures the affective elements are in no wise distinct from the perceptual. The assumption that a sensation is determined for all time by its stimulus must be given over, for a sensation is only a highly elaborate and refined structure, entirely a product of analysis, and in no sense an original datum of mind. Thus, for example, the color discrimination of infants, to which the author gives detailed consideration, must be reinterpreted in terms of structures, light and dark, 'warm' and 'cold', colored and uncolored, in place of the discrete sensory elements which have hitherto been assumed to indicate the presence or absence of color sensitivity.

Transfer of training is readily understood as an acquisition of structures; for within a broader structure a partial structure of similar form may find facilitation of expression, whereas Thorndike's doctrine of 'identical elements' makes no such provision for flexibility of application. Again, learning to read by sight through sheer repetition is futile, because one never learns anything unless opportunity is given for recitation in

which the material can be worked over into a structural form. Learning is never a mere connection of impressions or acts, but always a certain *way* of acting. But, a certain way of acting having been learned, quite different materials both of perception and of response may be suited to the performance; for it is not the materials, either as sensory ingredients or as specific muscular reactions, which constitute the phenomenal structure that has been learned, but something quite different, conditioned by the functional uniformity of the organism in its biological processes.

Here, however, the author leaves us in doubt, for apparently he has no psychological doctrine of integration by means of which the analytic data of the phenomena of perception are shown to constitute these mental structures. If the same structure may arise under totally different conditions of stimulation and persist through various muscular adjustments of response, is there no strictly phenomenal pattern by which the identity of the structure can be gauged? It would seem that Koffka regards this identity of structure as sufficiently defined in terms of its biological function; but though he attempts to overcome the opposition of mechanism and vitalism as alternate explanations, by an interpretation which is neither the one nor the other, he is not altogether successful in making clear his emancipation from teleology. Much attention is given to the variety of structures, primitive and acquired, and also to the genesis of series and groups in perception and in movement, but one is troubled by the lack of an unequivocal determination within the phenomenal realm of consciousness itself.

In considering the tests of Köhler on apes and hens with respect to the apparent size of objects and the surface-color of labels, one might suppose from the results obtained that within the structural range of an ape's view there is no phenomenal difference in the perceived size of an object as it recedes into distance, and likewise that the surface-color of a neutral grey remains phenomenally constant even when its comparative brightness has been reversed with reference to the 'negative' color of the training series. The facts as indicated in Köhler's careful tests are unimpeachable, yet no attempt seems to be made to account for them in phenomenal terms. A similar criticism has been made of Wertheimer's 'phi phenomenon,' as the essential structure of visual movement; but Dimmick found conscious data for the 'phi phenomenon' as a grey flash integrating with an attribute of duration.[1]

Even if we are now led to relinquish elemental sensations and their association as the groundwork of psychology, must we turn to biology, with its teleological or mechanistic implications, for the interpretation of every mental structure that a concrete act of behavior may imply? Is it not rather the problem of psychology to investigate these mental structures as integrations of qualities involved in their membership, in order that the gross nature of the structured *quale* may be reduced to attributive aspects such as qualitative modality, intensity, duration, spread, etc., each one of which can be controlled by a corresponding variation of the stimulus? One has an uneasy feeling that these new phenomenologists of mental structure are too ready to posit the phenomenal side of behavior as unique data which cannot be more closely defined. Yet a structure whose members are incapable of definition is hardly a scientific datum, and if every definition must be functional, that is, organic, psychology is still thrown back upon the tender mercies of biology, just as surely as the behaviorist argues that it must be. Even though the physical universe itself, which supplies the 'situations' for behavior, is rightly conceived as an elaborate interconnection of structures to which no mechanistic interpretation of accretion and summation can ever do justice, yet the uniformities of the physical universe do submit to definition. Why not also the corresponding uniformities of the mental structure, and, indeed, in much the same way?

[1]Cf. this JOURNAL, xxxi., 1920, p. 317 ff.

These are but some of the questions which come to one's mind after attempting to digest this somewhat bewildering review of the subtleties of mental development and child-life that Koffka has managed to compress within the limits of a small book. We have neglected to trace the outline of his treatise, and have omitted many illuminating inferences which carry us far beyond the crude and stodgy interpretations which are still current in present-day American pedagogy. But it seemed more important, in attempting to bring this very significant point of view to the attention of American readers, to devote our space to the new theory and certain of its implications, rather than to review the book with reference to its specific content. We may venture to hope that the volume will be widely read by educational psychologists, because it is filled with nuts for the behaviorist to crack, and if not all are ready to throw over their pet theories of applied psychology in favor of the one here proposed, no one can fail to benefit from the redefinition of his conceptions which the reading of this book will force upon him.

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A Treatise on Probability. By JOHN MAYNARD KEYNES. London, 1921. Pp. xi + 466. Price 18s.

The author of the *Economic Consequences of the Peace* here sets forth a logic of probability, an attempt to treat in comprehensive and systematic fashion the problems of the philosophy of induction with the related general principles of mathematical probability and statistical inference. The work belongs to the course of thought initiated by Leibniz, left undeveloped for a time, brought again into prominence by Hume and Mill, and revivified and applied to the concrete by Laplace and Jevons and Venn. The treatise itself was begun as a fellowship dissertation at Cambridge under the influence of W. E. Johnson, G. E. Moore, and Bertrand Russell, to whom it owes much both for problem and method. After the interruption due to war work, it is now modestly presented "for criticism and enlargement at the hands of others." It intends to supplant by constructive theory some of the negative criticism contained in the chapters on induction in our present-day texts on logic, but it offers also a wealth of critical material to mathematicians who are willing to be concerned with the presuppositions of the theory of probability, as well as a variety of suggestion and caution to all who make use of statistical methods in seeking scientific conclusions.

The book is divided into five parts, with an index, and a selected and briefly annotated bibliography of 25 pages.

Part I gives the general epistemological setting. Probability is defined in its widest sense as a *relation* between propositions (premises) which are derived by direct knowledge, and other propositions (conclusions) which are derived from these indirectly by argument (inference). If not completely implied in and deducible from the data (premises) themselves, all conclusions thus have only a certain probability, and all true induction is effected by the application of a general theory of probability.

Probability, being itself a relation, is always relative to the data upon which it is based. A given conclusion may be probable on one set of data, and improbable on another set. Independent certainty, therefore, can be regarded only as the limit of all possible probability relations, based upon infinite (and therefore practically unattainable) data.

Keynes holds that probabilities, thus generally defined, are not always comparable, even theoretically. Expressed metaphorically, the "path" from data to conclusion is not always straight, and probabilities lying on two different paths may belong to different and incomparable orders. The measurement and mathematical comparison of two probabilities are